

Imaging Biological Cells using Soft X-ray Tomography

(Keynote Presentation)

Carolyn Larabell

University of California San Francisco School of Medicine and
Lawrence Berkeley National Laboratory

Until recently, transmission electron microscopy (TEM) was the only technique available for obtaining high-resolution images of cellular structures. Since intact cells are transparent, comprised of about 70% water, and too large to be penetrated by an electron beam (microorganisms are several microns in diameter; most mammalian cells are at least 10 microns diameter), extensive specimen preparation techniques are required. Cells must be dehydrated using a slow, gradual incubation in increasing concentrations of solvents; this leads to collapse of delicate structures as well as loss of soluble cell components. Cells also must be stained with heavy metals to generate sufficient contrast. Finally, cells must be embedded in plastic to facilitate collection of ultra-thin (≤ 100 nm) sections capable of electron beam penetration. The extensive processing required to image just a small portion of a cell is destructive and time-consuming, taking from 3-5 days. Soft x-ray tomography (SXT) is an excellent alternative for imaging cell structures in the native state, avoiding all of the damaging processing required for TEM. Cells are simply rapidly frozen, placed in a goniometer, and imaged from multiple angles. Three-dimensional images of an entire cell can now be imaged in just five minutes. At the National Center for X-ray Tomography in Berkeley California, we are working with a large number of biologists from around the world to image a variety of different cell types. I will present examples of many of these projects that reflect the broad applications of SXT.

Presenting Author

Carolyn Larabell is Professor and Vice-Chair in the Department of Anatomy at the University of California San Francisco School of Medicine, with a joint appointment as Advanced Light Source Professor at Lawrence Berkeley National Laboratory. She is also the Founding Director of the National Center for X-ray Tomography (NCXT), a NIGMS-NIH Biomedical Technology Research Resource, to develop soft x-ray microscopy for imaging biological cells. Dr. Larabell received her Ph.D. from Arizona State University and did postdoctoral training at Stanford University and the University of California at Davis.

